NASA's Mission Operations and Communications Services

This Description applies only to proposals in response to NASA's Announcement of Opportunity for Medium-class Explorers (MIDEX) and Missions of Opportunity

AO 01-OSS-xx

June 2001

1.0 INTRODUCTION

This document is intended to assist in the preparation of proposals in response to an Announcement of Opportunity (AO) issued by NASA's Office of Space Science (OSS) for Medium-class Explorers (MIDEX) and Missions of Opportunity. NASA provides many operations and communications services that are available for NASA missions. The use of these services will incur costs to the user and estimates for these costs need to be included in proposals submitted under this AO. To facilitate proposal preparation, proposers are to read this appendix and contact the individuals named in Section 1.6 below.

1.1 Costing Policy

As a matter of policy, NASA will include estimated costs for mission operations and communications services, as well as an assessment of key parameters for mission operations, in the evaluation and selection processes for all Earth-orbiting and deep space missions. The OSS and the Space Operations Management Office (SOMO) are implementing this policy:

- in anticipation of formal NASA-wide full-cost accounting,
- to better manage our currently oversubscribed communications resources,
- to encourage tradeoffs between on-board processing and storage vs. communications requirements, and
- to encourage proposers to design hardware and operations systems which minimize life cycle costs while accomplishing the highest-priority science objectives.

1.2 Choice of Service Providers

NPG 7120.5A (Sections 2.1.5c and 3.1.5c) requires all programs/projects to develop requirements during mission formulation for space operations services from the NASA Space Operations Management Office (SOMO). Services provided by SOMO include support for communications, tracking, mission operations, flight dynamics, and data processing. NPG 7120.5A requires projects to use SOMO services unless a more cost-effective life cycle can be proposed.

Programs/projects are thus free to propose use of services from sources other than SOMO. Projects should conduct trade studies on the use of SOMO-provided services versus any proposed alternatives. NASA-initiated projects (e.g., strategic plan missions) in OSS should conduct such trade studies in Phase A. Competitively selected projects (PI-class missions) in OSS may optionally conduct such studies in Phase A, but should conduct such studies no later than Phase B. In general, SOMO-provided services should be employed whenever they meet mission objectives at a life-cycle cost to the project or to the Enterprise that is less than or equal to any proposed alternatives. SOMO will assist NASA projects and PI missions in identifying SOMO services, prices, and cost trades.

If the Enterprise and SOMO agree that the project or PI approach does not result in the lowest life cycle cost, the Enterprise may direct the project/PI to modify their approach. If the SOMO approach increases the project/PI cost but reduces cost to the Enterprise, any funding impacts to the project/PI will be resolved by the Enterprise.

If a trend towards project/PI-unique solutions appears to reduce individual mission costs but increases total cost to NASA by not utilizing shared services and facilities, any resolution using the appropriate NASA-wide services strategy will be implemented in a manner in which the Enterprise shares in the cost savings.

If SOMO and the Enterprise can not agree on which alternative is more cost effective, the Space Operations Council will resolve the issue.

1.3 SOMO Services

NASA has consolidated management of space mission operations, space-ground communications, and ground wide area networks under SOMO at the Johnson Space Center. Consolidation of these systems, including the Deep Space Network (DSN), the NASA Ground Network (GN), the Tracking and Data Relay Satellite System (TDRSS), the NASA Information Services Network (NISN), and mission operations systems, was performed to enable migration to a common architecture across the agency, eliminate redundancy, and share resources. The ultimate objective is to reduce the cost of operations and increase funding available for science. Most space operations services are provided through a Consolidated Space Operations Contract (CSOC), with some selected services (e.g., international DSN sites) managed by NASA Centers.

SOMO services are generally categorized as Mission Services (flight operations, flight dynamics, and science data processing) and Data Services (space-ground and terrestrial communications). Mission Services are defined by working with a project to understand the operations concept and science requirements, and to determine cost/performance/risk trades. For Data Services, SOMO has moved from a facilities-based support approach to one based upon standard services defined in terms of "units of service" and "cost per unit". The *SOMO Services Catalog* defining these services is available from the Customer Commitment Office web site, which can be accessed directly from the SOMO home page:

http://www.jsc.nasa.gov/somo/

Table 1 provides a summary of SOMO services.

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Table 1: Summary of SOMO Services

Mission Services:		
SOMO Service Category	Brief Description	
Mission Planning	Advanced mission analysis supporting mission design and service selection decisions Development of documentation which specifies launch vehicle, spacecraft, crew, payload, ground system, and network activities during the various phases of mission preparations and operations Preparation of test plans and monitoring of readiness test and training activities Support of critical/key event execution during the pre-launch, launch, and critical early orbit phases of the mission	
Flight Operations	Operation of spacecraft and instruments Health and safety monitoring Performance analysis and anomaly resolution Command management Scheduling of spacecraft-ground communications	
Flight Dynamics	Navigation services, encompassing spacecraft trajectory determination and control, including trajectory design and maneuver planning, as well as supporting physical modeling Attitude services, including spacecraft attitude determination and control, sensor modeling and calibration, and attitude reference modeling services Launch trajectory services, involving real-time ascent-phase trajectory monitoring, acquisition support, and associated pre-launch preparations and simulations	
Science Data Processing	Data ingest from Space Network (SN), Ground Network (GN), Deep Space Network (DSN), or commercial sources Frame synchronization Error detection and correction (including Cyclic Redundancy Check (CRC)), Pseudo-Random Noise (PN) decoding, and Reed-Solomon decoding Forward time-ordering of data Redundant data deletion Product generation from Level 0 through higher levels if required Electronic distribution of data products (hard media distribution may be arranged with extra cost for packing and shipping) Physical Media Data reprocessing and/or redistribution Note: Some mission requirements that typically have significant impact on system design and/or operations staffing are data format, data volume, complexity of processing, data distribution characteristics, reprocessing frequency, and data latency requirements. Services may be performed using a data processing system that currently exists or a system that is provided by the customer.	

Data Services	
SOMO Service Category	Brief Description
Space-Ground Communications	
Space Network	Communication via Tracking and Data Relay Satellite System (TDRSS)
Ground Network	Communication to low-Earth orbit via polar and equatorial ground stations
Deep Space Network	Communication to planetary and deep space distances via ground stations
Wide-Area Networks	
NASA Integrated Services Network (NISN)	Terrestrial communications via commercial carriers: dedicated and switched circuits, packet data transport, voice and video.
Range Services	
Control, Tracking and Data Acquisition Services	Support to sub-orbital missions (aircraft, balloon, sounding rockets).

1.4 Process for Requesting Services

Proposers should contact SOMO for information on NASA's mission operations services and costs at the time when initial science operations concepts are being defined. A Customer Service Representative will be assigned to provide information on SOMO services and costs, and will assist in documenting initial mission operations requirements in a format termed a "Service Request". The Customer Service Representative will coordinate with SOMO representatives at other NASA centers as needed to provide integrated support from all SOMO service providers. During the study phase, as the proposer's mission concept becomes more clearly defined, the requirements in the Service Request will be clarified, and the resulting documentation of services and costs agreed to by the proposer will become a "Project Service Level Agreement (PSLA)" to be signed by a SOMO representative and the proposer. The PSLA will identify all mission operations requirements, even those provided by non-SOMO sources, to provide a source of end-to-end operations information and to reference any cost analyses leading to the selection of non-SOMO services.

1.5 Standards

It is NASA policy that space missions receiving funding from NASA comply with all international and United States regulations, standards, and agreements. Such regulations and standards include those promulgated by:

International Telecommunications Union (ITU)
National Telecommunications and Information Agency (NTIA)
Consultative Committee for Space Data Systems (CCSDS)

Space Frequency Coordination Group (SFCG)

Information about the ITU and NTIA regulations can be obtained from the NASA Management Office at the Glenn Research Center or by consulting References 1 and 2. Recommended standards applicable to DSN, Ground Network, or TDRSS support can be obtained from Reference 3, the CCSDS home page.

1.6 SOMO Contact Information

The primary SOMO point of contact for this AO is the SOMO Lead Center Mission Services Manager (CMSM) for the Small Explorers missions:

Jon Walker
GSFC Center Customer Commitment Manager
Code 450
Goddard Space Flight Center
Greenbelt MD 20771

e-mail: jon.walker@gsfc.nasa.gov

Phone: (301) 286-7795

For information about NASA's overall mission operations and communications service plans, contact:

John Dalton SOMO Customer Commitment Manager Code 720 Goddard Space Flight Center Greenbelt MD 20771

Phone: (301) 286-5713 Fax number: (301) 286-1765

e-mail: john.dalton@gsfc.nasa.gov

Any further questions concerning mission operations functions or services should be directed to the Explorer Program Scientist listed in paragraph 6.1.2 of this AO.

2.0 REFERENCE DOCUMENTS

Prospective users of SOMO and TMOD facilities can obtain additional information from the following documents:

- SOMO Services Catalog, NASA Space Operations Management Office, Lyndon B. Johnson Space Center, National Aeronautics and Space Administration, Code TA, 2101 NASA Road 1, Houston, Texas 77058. Copies of the document are available at: http://www.jsc.nasa.gov/somo/.
- 2. Radio Regulations, International Telecommunications Union, Geneva, Switzerland.
- 3. Manual of Regulations and Procedures for Federal Radio Frequency Management, National Telecommunications & Information Administration, U.S. Department of Commerce, Washington D.C., Latest Edition. Information is available at: http://www.ntia.doc.gov/osmhome/redbook/redbook.html
- 4. Consultative Committee for Space Data Systems (CCSDS). Blue Books published by the CCSDS Secretariat, NASA Headquarters, Washington D. C. 20546. *Copies of CCSDS Recommendations are available at:* http://www.ccsds.org/blue_books.html. *CCSDS CFDP information is available at:* http://www.ccsds.org/red books.html.
- 5. Handbook of the Space Frequency Coordination Group, ESA Frequency Manager and SFCG Secretariat, European Space Agency Headquarters, 8-10 Rue Mario Nikis, 75738 Paris, France. Copies of the document are available at: http://www.sfcgonline.org/home.shtml
- 6. TMOD's Mission Operations and Communications Services (A Handbook for Preparing Proposals), Telecommunications and Mission Operations Directorate, Jet Propulsion Laboratory, Pasadena, California, Latest Edition. Copies of the document are available at: http://deepspace.jpl.nasa.gov/advmiss
- Telecommunications and Mission Operations Directorate Services Catalog, Organization 920, Jet Propulsion Laboratory, Pasadena, California, V 6.0 (or later edition), September 1998. http://jpl-madb.jpl.nasa.gov/srp/catalogHTML/CATALOG-FS.htm